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DM7 Resolver Decoder
(Single Turn, Single Channel)
Instruction & Operation Manual

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Programmable Resolver Decoder

Single Turn, Single Channel

Instruction Manual

The DM7 Decoder

Principle of Operation

The DM7 series resolver to digital decoder provides an absolute encoder system in conjunction with any one of the Autotech's single turn resolvers. As shown in the diagram on the next page, the resolver rotor winding is excited from a reference sinusoidal generator inside the DM7 unit. The analog output signals from the resolver stator windings, after signal conditioning in the buffer amplifiers are decoded to digital format in the ratiometric tracking converter. The zero offset entered from the front panel keypad is continuously added to this digital value. The offsetted digital data is scaled, converted to the digital format as selected from the keypad and displayed on the front panel of the unit. The position information is also made available in a parallel format for external devices, such as Programmale Logic Controllers (PLCs), remote displays, etc.

Programmable Full Scale Offset for Easy Setup

The resolver can be mounted on the machine without any concern for mechanically aligning the resolver zero to the machine zero. Once resolver is coupled to the machine shaft, the only thing you have to do is to bring the machine to a known position, say home position, and set an offset number from the front panel keypad until the display reads zero position. This is especially useful during initial start up in that it reduces the setup time. The offset can also be used to compensate for any machine wear.

Programmable Resolution; 20–4096 Counts per Turn

The programmble scale factor feature provides you the flexibility of selecting the resolution in the field. Now you do not have to worry about defining the resolution at the time of ordering the unit. The scale factor can be programmed from the front panel and can be any number between 19 and 4095 resulting in resolution of 20 to 4096 counts per turn. This feature allows you to scale the position to desired engineering units (inches, mm, etc.) if required.

Front Panel Selectable Output Formats — BCD, Binary or Gray Code

The DM7 is an extremely versatile resolver to digital decoder. Now you do not have to define the ouput format at the time of ordering the unit. Depending upon your application, the output format such as BCD, Natural Binary or Gray Code can simply be selected from the front panel keypad. This means one unit for various applications.

Built-in PC Synchronization

PC synchronization is built in as standard in DM7 resolver to digital decoder. Depending upon the application it can be selected from the front panel keypad to operate with or without PLC sync circuit. When selected to operate with PLC sync circuit, it provides an error free method of interfacing BCD or binary position data from the decoder to any PLC in the market. Upon receipt of a data transfer command from the PLC, the stable data is latched and made available to the PLC.

When selected to operate without PLC sync circuit (transparent or microfreeze mode), the position data is continously updated. At the data transfer command from a microcomputer, the data is latched for 100 ± 10 μs for the microcomputer to read the information.

Self Diagnostics with Fault Output

The DM7 is provided with an internal self check circuit that continuously monitors if the microprocessor is not in reset, input 120 VAC power, DC power supplies, resolver cable and output enable circuit. In case a fault occurs in any one of the above critical functions, the unit goes into fault mode and a transistor output changes state from ON to OFF. For failsafe operation, the fault ouput is ON for normal operation and turns OFF when a fault occurs. During the fault mode all ouputs are disabled automatically.

Highly Noise Immune Circuitry

Ratiometric tracking converter technique employed for resolver to digital decoding provides the best protection against electrical noise generated by power line transients and varying ground potentials. This decoding method is inherently immune to temperature changes and line frequency variations. The optical isolation adds an additional layer of protection against electrical noise and enhances the environmental integrity of the system.

Built-in Tachometer & Over/Under Speed Switch

The shaft RPM is continuously displayed on the front panel. Two additional outputs, one overspeed and the other under speed, are provided. The reference speed values are entered from the front panel.

Program Security

A supervisory input is needed to make any changes to the program to protect against unauthorized tampering.

Rugged and Reliable Resolver as Position Transducer

The DM7 series of resolver decoder combines the ruggedness of a resolver and reliability of an advanced solid-state control. The rugged heavy duty NEMA 13 IP54 resolver can be mounted on a machine in any hostile industrial environments, such as; mechanical shock vibrations, extreme humidity and temperature changes, oil mist, coolants, solvents, etc. Also, the resolver to digital decoder can be mounted up to 2500 feet away in a control panel.
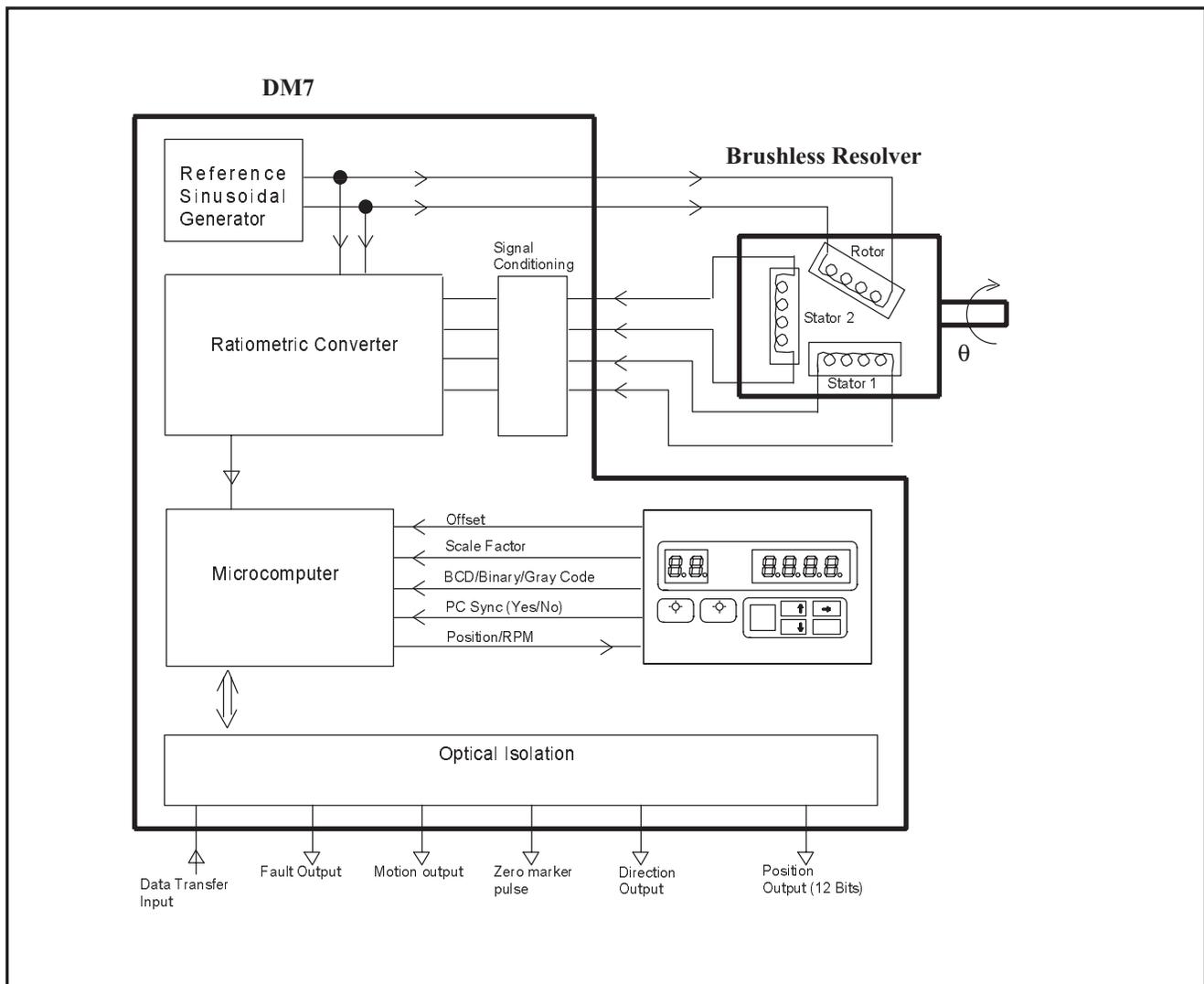
Installation and Operation

1. Introduction

A functional block diagram of Autotech's Programmable resolver decoder model DM7 is shown below:
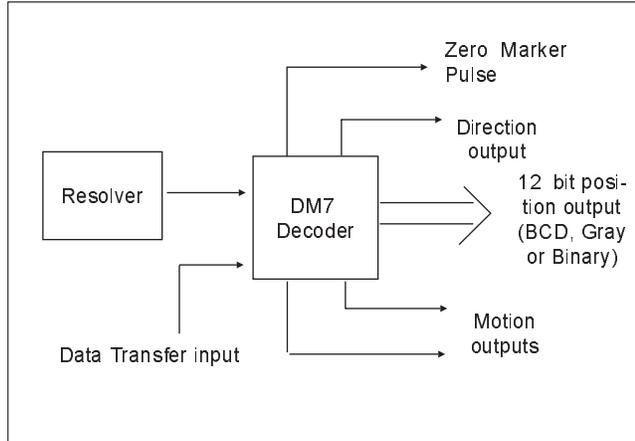
As shown, the DM7 accepts an input from a single turn resolver (such as Autotech's RL100, E6R, E7R, & E8R series of resolvers, etc.) and decodes it to give a scaled 12 bit digital position signal, giving a resolution of 4096 counts per turn. The decoded resolver position information is displayed on the front panel of the unit, and is available on a 25 pin sub D connector. The format of position output is front panel key board selectable as BCD, Gray code, or natural binary format.

The DM7 also provides a direction and two motion outputs. The high and low limits of the motion are programmable. The overspeed output is true when resolver speed is more than the programmed high limit, and underspeed output is true when the resolver speed is below the programmed low motion limit. The direction output is energized when the position is increasing.

The scale factor (desired counts per turn minus one) is programmable from 20 to 4095 to match the display and position to any output desired units in this range. For example, a scale factor of 359 may be selected to display resolver position in degrees, and a scale factor of 3599 will display the position in tenths of a degree. A static offset value may be programmed in the unit to electronically align resolver zero with machine zero.

The DM7 supports PC handshake for reliable data transfer from DM7 to external devices such as PLC or computers.

The unit may be ordered with TTL, P-, N- or C-type of outputs. It is packaged in a 1/8 DIN size enclosure, and has a NEMA 12 rating.

2. Front Panel
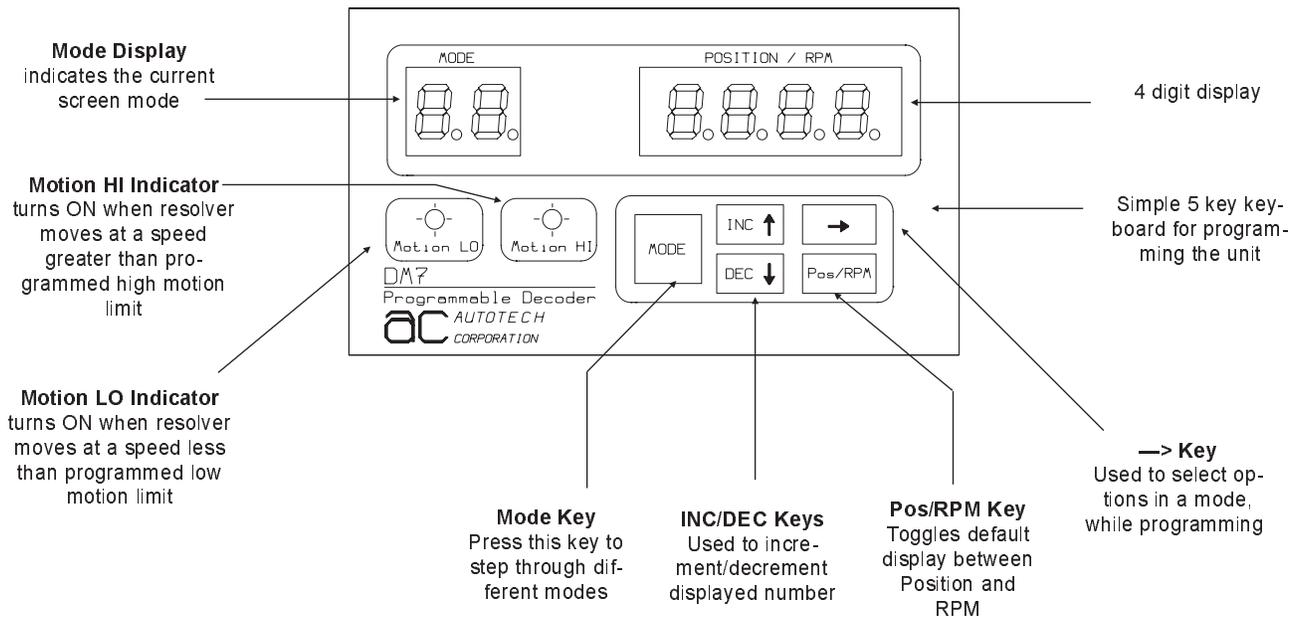
3. Mounting Dimensions

The figure below gives mounting dimensions of the DM7. The unit is housed in a 1/8 DIN panel mount case, and requires a rectangular panel cutout only (no mounting screw holes are required). Slide the unit in through the panel opening with gasket, insert the two right-angle mounting brackets into the openings on either side of the DM7 housing and slide brackets 1/4" towards the back of the unit to secure the brackets to the housing. Tighten the pair of screws on the right-angle brackets to hold the unit into the panel. *DO NOT OVER-TIGHTEN (80 inch-oz. torque max)!*

2.190
4.110
1.70
5.855
6.120

1.80
PANEL CUT OUT
3.75

Note:
Allow a minimum of 2.75 inches for DB connector
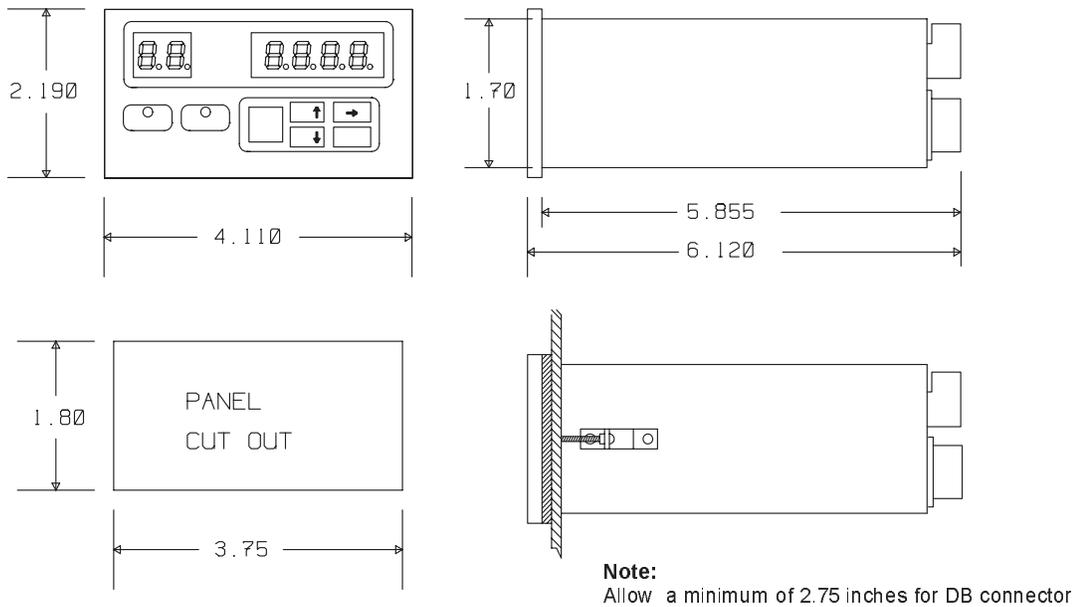
4. Typical Output Configurations

N and C output option
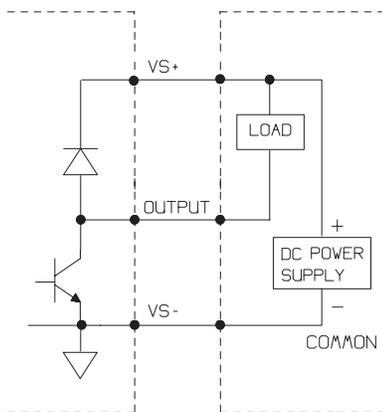
P output option

TTL output option

VS+
LOAD
OUTPUT
DC POWER SUPPLY
VS-
COMMON

VS+
DC POWER SUPPLY
OUTPUTS
LOAD
VS-
COMMON
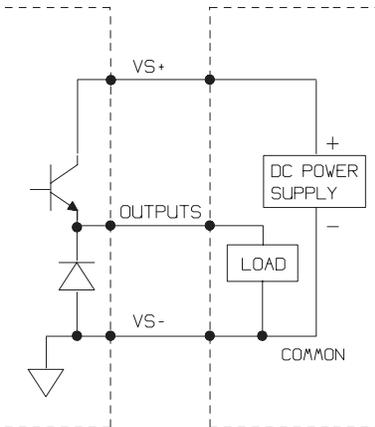
5V POWER SUPPLY REGULATOR
VS+
11-28 VDC
TTL DRIVER
OUTPUT
TTL COMPATIBLE LOAD
VS-
COMMON
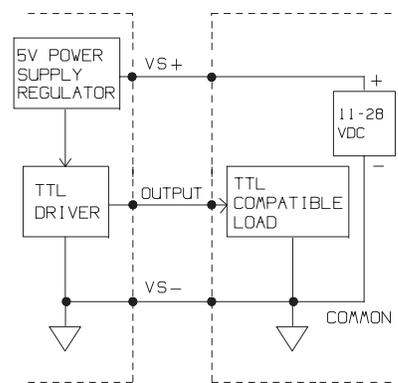
5. Rear View and Wiring Diagram

Note:
Determined by output logic option (see pg. 8)
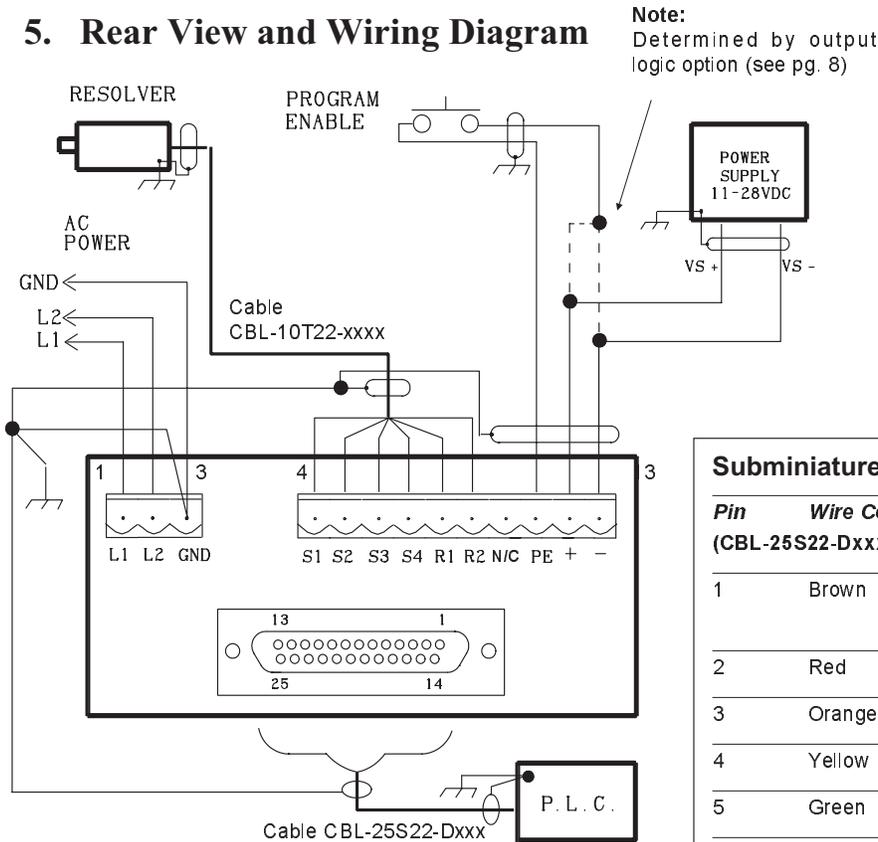
CBL-10T22-xxxx Cable

Wire Color	Resolver terminal	
Green-Black	R1	Twisted pair
Green	R2	
Yellow-Black	S1	Twisted pair
Yellow	S3	
Blue-Black	S2	Twisted pair
Blue	S4	

Note:
To change the resolver ascending count direction, reverse S1 and S3 connections.

Notes on grounding and shielding:

(Failure to observe any of these requirements may cause unpredictable operation and will void warranty)

1. All logic level wiring (including resolver and external power supply) must be done using overall foil shielded cables, with shields and equipment grounded as per above drawing. See *How to Order* section for suitable cables offered by Autotech.

2. Resolver shielded cable must consist of twisted pairs, and the twisted pairs must be wired as per wiring instructions. See *How to Order* section for a suitable resolver cable offered by Autotech.
   It is recommended that the resolver shielded cable be run in its own separate conduit.

3. All ground planes on which the DM7 and all external equipment are mounted must be held to the same RF potential, by good metallic connections to building frames, conduit or wiring trays.

4. All shielded cable must be kept at a minimum distance of 2 inches from all high voltage or inductive wiring.

5. All shielded cable must be kept at a minimum distance of 12 inches from all motor wiring controlled by AC or DC drives.

Subminiature-D Pin Definitions

Pin (CBL-25S22-Dxxx)	Wire Color	Function/Bit values with		
		BCD	Binary	Gray Code
1	Brown	Output enable (For P and N options or Mux for TTL) (see pg 8, Inputs)		
2	Red	Do not use		
3	Orange	Fault output (Energized if unit is O.K.)		
4	Yellow	4000	NC	NC
5	Green	1000	NC	NC
6	Blue	400	B10	G10
7	Purple	100	B8	G8
8	Grey	40	B6	G6
9	White	10	B4	G4
10	Black	4	B2	G2
11	White/Brown	1	B0(LSB)	G0(LSB)
12	Black (12 ga)	VS– (Common)		
13	White/Orange	Data Transfer input (see para. 6.8)		
14	White/Yellow	Overspeed Output		
15	White/Green	Underspeed Output		
16	White/Blue	Direction Output		
17	White/Purple	2000		
18	White/Grey	800	B11(MSB)	G11(MSB)
19	Wht/Blk/Grey	200	B9	G9
20	White/Black	80	B7	G7
21	Wht/Blk/Brown	20	B5	G5
22	Wht/Blk/Red	8	B3	G3
23	Wht/Blk/Orange	2	B1	G1
24	White (12 Ga)	VS+ (+11 to +28 VDC)		
25	Wht/Blk/Yel	Zero Crossing Marker Pulse Output		

6. Programming

Programming the DM7 requires entering of the following values/options for the unit:

- **Scale Factor:** desired counts per revolution minus one
- **Offset:** constant to be added to the true resolver position, used to align machine zero with resolver zero.
- **Motion Hi Limit:** the overspeed output is energized when resolver turns at a speed greater than this speed.
- **Motion Lo Limit:** the underspeed output is energized when resolver turns at a speed less than this speed.
- **Output type option:** BCD, Gray or Binary
- **PC sychronization option:** yes or no

The five keys on the front panel are used in the following manner:

Used to step through different programming screen. The two 7-segment LEDs indicate the current screen or mode.

The INC/DEC keys are used to increase/decrease numerical entries, such as scale factor offset, etc.

Used to display and select options for output type and PC sync screens.

Used to toggle the default display between Position and RPM display. Pressing this key any time returns display to Pos/RPM

> **Note:**
> The program enable input must be True to allow programming of the unit.

6.1 Default Display

The DM7 normall displays the position (true resolver position + offset), or RPM of the resolver. The display may be toggled between these two by pressing Pos/RPM key. The Pos/RPM key may be pressed to bring up the default display

any time. Also, if there is no key pressed for one minute, the unit returns to its default display. The position display is as follows:

After a short time "Po" blalnks out. The RPM display is as follows:

The INC, DEC keys are ignored in this mode.

6.2 Scale Factor Programming

Press **MODE** to display

Current scale factor is displayed

Use **INC↑** or **DEC↓** to increase or decrease the displayed number until desired scale factor is displayed

Please note:
- Scale factor = desired counts per turn – 1
- Scale factor programming is inhibited when resolver is moving

6.3 Offset Programming

Press **MODE** to display

Current offset is displayed

Use **INC↑** or **DEC↓** to increase or decrease the displayed number until desired offset is displayed

Please note
- Default position display = true resolver position + offset

Thus offset may be used to electronically align resolver to machine zero. The offset should be less than the scale factor.

6.4 Motion High Limit Programming:

Press [MODE] to display `Hı 234`

Current Motion High Limit is displayed

Use [INC↑] or [DEC↓] to increase or decrease the displayed number until desired Motion High Limit is displayed

Please note:
- The over speed output is energized when resolver rotates at a speed greater than this limit

6.5 Motion Low Limit Programming:

Press [MODE] to display `Lo 234`

Current Motion Low Limit is displayed

Use [INC↑] or [DEC↓] to increase or decrease the displayed number until desired Motion Low Limit is displayed

Please note:
- The under speed output is true when resolver rotates at a speed lower than this limit

6.6 Decimal Point Programming:

While displaying Pos/RPM, press

[→] to move decimal point to desired location.

Please note that decimal point is arbitrary, and not used in any computation.

6.7 Output Type Selection:

Note: *Selection is inhibited when resolver is moving*

Press [MODE] to display `Ot bcd`

i.e. "Ot" in left two digits, and right three digits will display the Current Output type programmed in the unit which may be bcd (for BCD), bin (for Binary), or gry (for Gray code)

Press [→] until desired option is displayed; the options are as follows:

`Ot bcd` for BCD output format

`Ot bın` for Binary output format

`Ot gry` for Gray code output format

Press [MODE] to save the displayed output type, and to select PC synchronization option

6.8 PC Sychronization Option Selection:

Note: *Selection is inhibited when resolver is moving*

If not already displayed,

press [MODE] to display `Pc YES`

i.e., "Pc" in left two digits, and right three digits will display the Current PC synchronization option programmed in the unit, which may be yes or no.

Press [→] till desired option is displayed; the options are as followed:
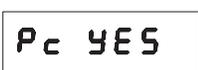
`Pc YES` to enable PC synchroniztion

`Pc no` to disable PC synchronization

PC synchroniztion: When enabled, the outputs are updated within 150 µs of the data transfer input signal (rising or falling edge).
When disabled the outputs are updated continuously (but asynchronously) and are latched for 100 ± 10 µs after data transfer input edge

Press [MODE] to save the displayed option, and to return to Pos/RPM mode

Specifications

Input Power:

    AC: 105 to 135 VAC, 7 VA; Optional 220, 240 VAC
    DC: 11 to 28 VDC, 100 mA (typical) exclusive of load

Operating Temperature:

    −10 to +130°F (−23 to +55°C)

Position Transducer:

    Autotech's series RL100, E6R, E7R, E8R or RL101 re-solvers

Signal Resolution: 20 to 4096 counts/turn

Programmable Scale Factor: 19 to 4095

Output Update Rate: 200 μs

Programmable Offset: Full revolution

Decimal Point: Programmable after any digit

Resolver Cable Length: 2500 Ft. (max) shielded

Resolver Cable: Autotech, CBL-10T22-xxx

Outputs:

    Output Option:
    T: LS TTL (74LS645)
      Logic True: 2 VDC @ 15 mA,
              20 μA leakage when tristated;
      Logic false: 0.35 V @ 24 mA,
              0.4 mA leakage when tristated
      Mux Input: Low active TTL level
          Logic True: 0 to 0.8 V;
          Logic False: 2 to 5 V
    P: PNP source transistor;
      Logic True: Transistor ON, 1.7 V drop @ 100 mA;
      Logic False: Transistor OFF, 0.2 mA leakage
      @ 50 V
    N: NPN sink transistor;
      Logic True: Transistor ON, 1.1 V max @ 100 mA;
      Logic False: Transistor OFF, 0.1 mA leakage
      @ 50 V
    C: NPN sink transistor;
      Logic True: Transistor OFF, 0.1 mA leakage
      @ 50 V
      Logic False: Transistor ON, 1.1 V max @ 100 mA

Position Output Format:

    Front panel selectable BCD, Gray code, Binary

Motion Outputs:

    Two; Overspeed & Underspeed;active high

Direction Output: Logic true for increasing position

Marker Pulse:

    Zero crossing pulse 200 μs min to 1.0 ms max

Output Isolation:

    All outputs optically isolated upto 2500 Volts

Inputs :

    Program Enable, Output Enable, Data transfer,
    Logic of inputs determined by output option.

    For "P" Type Units:
      Enable or True = 11.0 to 28.0 VDC @ 13.5 mA
                 max or tied to VS+
      Disable or False = 2.0 VDC @ 0.2 mA max or
              open circuit
    For "N" & "T" Type Units:
      Enable or True = 1.0 VDC @ -3.0 mA max or
              tied to VS-
      Disable or False = 3.8 to 28 VDC max @ -0.2 mA
              max or open circuit

Timing: Depends upon the PC sync option selected from keyboard. Minimum pulse width 30 μs. Edge triggered (i.e. data transfer on both rising and falling edges).

    PC Synchronization mode:
    Updates position output within 150 μs of a transition edge (low to high, or high to low) at data transfer input.

    Transparent Mode /Microfreeze:
    Output data is continuously updated at full speed. The data is latched for 100 ± 10% μs within 10 μs of a transition (high to low or low to high) at data transfer input.

How to Order

1. Programmable Resolver Decoder Model DM7

DM7-X̲ X̲ X̲ 0 0-010: Basic unit resolver-to-digital decoder, programmable
     1 2 3   output format (gray code, BCD, binary) and resolution
                  (20-4096 counts per turn)

1. *Type of unit*
   0: Basic Unit with AC power input-Must select "1" or "2" for input power below
   A: Available with only DC power input.
   Analog Unit- covered under separate manual
   (*i.e., Resolver Decoder DM7-A, MAN-DM7-A*)

2. *Input Power:*
   0: DC Power input, 12/24 VDC
   1: 117 VAC, 60 Hz
   2: 220 V/240 AC, 50 Hz

3. *Type of Output:*
   T: TTL, 5 V logic with multiplexing
   P: PNP source transistor, 100 mA max @50 V max, high true logic
   N: NPN sink transistor, 100 mA max @50 V max, low true logic
   C: NPN sink transistor, 100 mA max @50 V max, high true logic

1a. Slave Unit

DS7-XXX00-010:   Slave Unit for Model DM7 listed in "1" above.

2. Cable

CBL-25S22-Dxxx   Cable for digital output wiring with overall foil shield and 25 pin sub "D" connector on one end
                          xxx = Standard Length in feet (10, 25, 50 and in increments of 50 feet)

ECM-25PIN-M11   25 pin sub "D" male connector (mates with the connector on DM7).

3. Position Transducer

DM7 requires Autotech's single turn resolvers (such as RL100, E1R, E7R & E8R or E9R series of resolvers) as a position transducers. Consult section on Position transducer for ordering information on transducers, cables, couplings, and mounting brackets, etc.

WARRANTY

CAUTION